SUBJECT INDEX

Accounting

Pricing Construction Contracts Under Tax Reform Act of 1986, Foad Farid, CO June 90 p300-315.

Analysis

Framework for Analysis of Performance, William F. Maloney, CO Sept. 90 p399-415.

Analytical techniques

Bids Considering Multiple Criteria, John Seydel and David L. Olson, CO Dec. 90 p609-623.

Artificial intelligence

Hybrid Expert System for Construction Planning and Scheduling, Osama Moselhi and Matthew J. Nicholas, CO June 90 p221-238.

ASCE Awards & Prizes

Implementing Construction Research, Ben C. Gerwick, Jr., CO Dec. 90 p556-563.

Automation

Applying Computer-Integrated Manufacturing Concepts to Construction, Victor E. Sanvido and Deborah J. Medeiros, CO June 90 p365-379.

Bar Coding in Construction Engineering, William J. Rasdorf and Mark J. Herbert, CO June 90 p261-280.

Electronic Data Interchange in Construction, George E. Gibson, Jr. and Lansford C. Bell, CO Dec. 90 p727-737.

Framework for Construction Robot Fleet Management System, Jeffrey S. Russell, Miroslaw J. Skibniewski and Jorge A. Vanegas, CO Sept. 90 p448-462.

Bids

Bids Considering Multiple Criteria, John Seydel and David L. Olson, CO Dec. 90 p609-623.

Decision-Support System for Modeling Bid/No-Bid Decision Problem, Irtishad Ahmad, CO Dec. 90 p595-608.

Pricing Construction Contracts Under Tax Reform Act of 1986, Foad Farid, CO June 90 p300-315.

Bridge construction

Advanced Fabrication and Erection Techniques for Long Suspension Bridge Cables, Minoru Matsuzaki, Chihiko Uchikawa and Takeshi Mitamura, CO Mar. 90 p112-129.

Bridge decks

Construction Methods and Costs of Stress-Laminated Timber Bridges, Edward F. Sarisley, CO Sept. 90 p432-447.

Bridges, suspension

Advanced Fabrication and Erection Techniques for Long Suspension Bridge Cables, Minoru Matsuzaki, Chihiko Uchikawa and Takeshi Mitamura, CO Mar. 90 p112-129.

Bridges, wooden

Construction Methods and Costs of Stress-Laminated Timber Bridges, Edward F. Sarisley, CO Sept. 90 p432-447.

Building design

Cost Model for Reinforced Concrete Beam and Slab Structures in Buildings, Surinder Singh, CO Mar. 90 p54-67.

Cables, ropes

Advanced Fabrication and Erection Techniques for Long Suspension Bridge Cables, Minoru Matsuzaki, Chihiko Uchikawa and Takeshi Mitamura, CO Mar. 90 p112-129.

Case reports

Productivity Improvement Tool: Camcorders, Neil N. Eldin and Stephan Egger, CO Mar. 90 p100-111.

Surviving Failures: Lessons from Field Study, A. Jaafari and A. Schub, CO Mar. 90 p68-86.

Change orders

Predictors of Cost-Overrun Rates, Charles T. Jahren and Andrew M. Asha, CO Sept. 90 p548-552.

Claims

Resolving Disputes over Contract Notice Requirements, H. Randolph Thomas, Gary R. Smith and Dennis E. Wright, CO Dec. 90 p738-755.

Coastal engineering

Construction of Difficult Dry Dock in Yokohama, Japan, Tsutomu Kumamoto, Hitoshi Kameda, Masaru Hoshiya and Kiyoshi Ishii, CO June 90 p201-220.

Codes

Bar-Code Standardization in Industrial Construction, George Stukhart and E. Lynn Cook, CO Sept. 90 p416-431.

Testing Bar-Code Technology In Construction Environment, Leonhard E. Bernold, CO Dec. 90 p643-655.

Comparative studies

Applying Computer-Integrated Manufacturing Concepts to Construction, Victor E. Sanvido and Deborah J. Medeiros, CO June 90 p365-379.

Competition

Implementing Construction Research, Ben C. Gerwick, Jr., CO Dec. 90 p556-563.

Competitive bidding

Bids Considering Multiple Criteria, John Seydel and David L. Olson, CO Dec. 90 p609-623.

Decision-Support System for Modeling Bid/No-Bid Decision Problem, Irtishad Ahmad, CO Dec. 90 p595-608.

Computer applications

Computer-Aided Concrete-Placement Optimization, R. S. Phelan, F. Radjy, C. Haas and C. Hendrickson, CO Mar. 90 p172-187.

Conceptual Framework for Computer-Based Construction Safety Control, William A. Stanton and Jack H. Willenbrock, CO Sept. 90 p383-398.

Electronic Data Interchange in Construction, George E. Gibson, Jr. and Lansford C. Bell, CO Dec. 90 p727-737.

Expert Systems Applications in Construction Management and Engineering, Satish Mohan, CO Mar. 90 p87-99.

Qualifier-2: Knowledge-Based System for Contractor Prequalification, Jeffrey S. Russell, Miroslaw J. Skibniewski and David R. Cozier, CO Mar. 90 p157-171.

Computer models

Cost Model for Reinforced Concrete Beam and Slab Structures in Buildings, Surinder Singh, CO Mar. 90 p54-67.

Computer software

Computer-Aided Concrete-Placement Optimization, R. S. Phelan, F. Radjy, C. Haas and C. Hendrickson, CO Mar. 90 p172-187.

Electronic Data Interchange in Construction, George E. Gibson, Jr. and Lansford C. Bell, CO Dec. 90 p727-737.

Computerized simulation

Integration of Simulation with Expert Systems, Ali Touran, CO Sept. 90 p480-493.

Probabilistic Simulation Studies for Repetitive Construction Processes, Simaan M. AbouRizk and Daniel W. Halpin, CO Dec. 90 p575-594.

Concrete placing

Computer-Aided Concrete-Placement Optimization, R. S. Phelan, F. Radjy, C. Haas and C. Hendrickson, CO Mar. 90 p172-187.

Concrete, reinforced

Cost Model for Reinforced Concrete Beam and Slab Structures in Buildings, Surinder Singh, CO Mar. 90 p54-67.

Conflict

Resolving Disputes over Contract Notice Requirements, H. Randolph Thomas, Gary R. Smith anc Dennis E. Wright, CO Dec. 90 p738-755.

Constructibility

Construction Methods and Costs of Stress-Laminated Timber Bridges, Edward F. Sarisley, CO Sept. 90 p432-447.

Construction

Database Systems for Evaluating Construction Programs, J. K. Yates, CO Dec. 90 p624-642.

Dilemmas Facing Construction Education and Research in 1990s, Clarkson H. Oglesby, CO Mar. 90 p4-17.

Framework for Analysis of Performance, William F. Maloney, CO Sept. 90 p399-415.

Integration of Simulation with Expert Systems, Ali Touran, CO Sept. 90 p480-493.

Modeling Construction Labor Productivity, H. Randolph Thomas, William F. Maloney, R. Malcolm W. Horner, Gary R. Smith, Vir K. Handa and Steve R. Sanders, CO Dec. 90 p705-726.

Probabilistic Simulation Studies for Repetitive Construction Processes, Simaan M. AbouRizk and Daniel W. Halpin, CO Dec. 90 p575-594.

Surviving Failures: Lessons from Field Study, A. Jaafari and A. Schub, CO Mar. 90 p68-86.

Construction companies

Decision-Support System for Modeling Bid/No-Bid Decision Problem, Irtishad Ahmad, CO Dec. 90 p595-608.

Construction control

Formal Development of Line-of-Balance Technique, Zohair M. Al Sarraj, CO Dec. 90 p689-704.

Construction costs

Predictors of Cost-Overrun Rates, Charles T. Jahren and Andrew M. Asha, CO Sept. 90 p548-552.

Who Owns Float? Jerry L. Householder and Hulan E. Rutland, CO Mar. 90 p130-133.

Construction equipment

Framework for Construction Robot Fleet Management System, Jeffrey S. Russell, Miroslaw J. Skibniewski and Jorge A. Vanegas, CO Sept. 90 p448-462.

Realistic Model for Equipment Replacement, A. Jaafari and V. K. Mateffy, CO Sept. 90 p514-532.

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Construction industry

Applying Computer-Integrated Manufacturing Concepts to Construction, Victor E. Sanvido and Deborah J. Medeiros, CO June 90 p365-379.

Bar Coding in Construction Engineering, William J. Rasdorf and Mark J. Herbert, CO June 90 p261-280.

Bar-Code Standardization in Industrial Construction, George Stukhart and E. Lynn Cook, CO Sept. 90 p416-431.

Conceptual Framework for Computer-Based Construction Safety Control, William A. Stanton and Jack H. Willenbrock, CO Sept. 90 p383-398.

Dilemmas Facing Construction Education and Research in 1990s, Clarkson H. Oglesby, CO Mar. 90 p4-17.

Electronic Data Interchange in Construction, George E. Gibson, Jr. and Lansford C. Bell, CO Dec. 90 p727-737.

Evaluation of New Building Technology, James D. Lutz, Luh-Maan Chang and Thomas R. Napier, CO June 90 p281-299.

Expert Systems Applications in Construction Management and Engineering, Satish Mohan, CO Mar. 90 p87-99.

Implementing Construction Research, Ben C. Gerwick, Jr., CO Dec. 90 p556-563.

Predictors of Cost-Overrun Rates, Charles T. Jahren and Andrew M. Asha, CO Sept. 90 p548-552.

Principal Nature of Management in Japanese Construction Industry, Keizo Baba, CO June 90 p351-364.

Productivity Improvement Tool: Camcorders, Neil N. Eldin and Stephan Egger, CO Mar. 90 p100-111.

Technical Specifications' Effect on Construction, Jonathan T. Jackson, CO Sept. 90 p463-467.

Testing Bar-Code Technology In Construction Environment, Leonhard E. Bernold, CO Dec. 90 p643-655.

Construction management

Bar Codes: Prescription for Precision, Performance, and Productivity, Lewis H. Blakey, CO Sept. 90 p468-479.

Consequential Equipment Costs Associated with Lack of Availability and Downtime, Michael C. Vorster and Jesus M. De La Garza, CO Dec. 90 p656-669.

Database Systems for Evaluating Construction Programs, J. K. Yates, CO Dec. 90 p624-642.

Expert Systems Applications in Construction Management and Engineering, Satish Mohan, CO Mar. 90 p87-99.

Formal Development of Line-of-Balance Technique, Zohair M. Al Sarraj, CO Dec. 90 p689-704.

Framework for Construction Robot Fleet Management System, Jeffrey S. Russell, Miroslaw J. Skibniewski and Jorge A. Vanegas, CO Sept. 90 p448-462.

Modeling Construction Labor Productivity, H. Randolph Thomas, William F. Maloney, R. Malcolm W. Horner, Gary R. Smith, Vir K. Handa and Steve R. Sanders, CO Dec. 90 p705-726.

New Approach to Construction Management, Timothy Ch. U. Kalu, CO Sept. 90 p494-513.

Productivity Improvement Tool: Camcorders, Neil N. Eldin and Stephan Egger, CO Mar. 90 p100-111.

Progress-Based Construction Scheduling, Mustafa Pultar, CO Dec. 90 p670-688.

Testing Bar-Code Technology In Construction Environment, Leonhard E. Bernold, CO Dec. 90 p643-655.

Construction methods

Advanced Fabrication and Erection Techniques for Long Suspension Bridge Cables, Minoru Matsuzaki, Chihiko Uchikawa and Takeshi Mitamura, CO Mar. 90 p112-129.

Construction Methods and Costs of Stress-Laminated Timber Bridges, Edward F. Sarisley, CO Sept. 90 p432-447.

Evaluation of New Building Technology, James D. Lutz, Luh-Maan Chang and Thomas R. Napier, CO June 90 p281-299.

Probabilistic Simulation Studies for Repetitive Construction Processes, Simaan M. AbouRizk and Daniel W. Halpin, CO Dec. 90 p575-594.

RPM: Repetitive Project Modeling, Rehab M. Reda, CO June 90 p316-330.

Construction planning

Factors Affecting Construction-Planning Outcomes, Alexander Laufer and Dora Cohenca, CO Mar. 90 p135-156.

Hybrid Expert System for Construction Planning and Scheduling, Osama Moselhi and Matthew J. Nicholas, CO June 90 p221-238.

Realistic Model for Equipment Replacement, A. Jaafari and V. K. Mateffy, CO Sept. 90 p514-532.

RPM: Repetitive Project Modeling, Rehab M. Reda, CO June 90 p316-330.

Who Owns Float? Jerry L. Householder and Hulan E. Rutland, CO Mar. 90 p130-133.

Contract administration

Predictors of Cost-Overrun Rates, Charles T. Jahren and Andrew M. Asha, CO Sept. 90 p548-552.

Resolving Disputes over Contract Notice Requirements, H. Randolph Thomas, Gary R. Smith and Dennis E. Wright, CO Dec. 90 p738-755.

Technical Specifications' Effect on Construction, Jonathan T. Jackson, CO Sept. 90 p463-467.

Contract terms

Resolving Disputes over Contract Notice Requirements, H. Randolph Thomas, Gary R. Smith and Dennis E. Wright, CO Dec. 90 p738-755.

Technical Specifications' Effect on Construction, Jonathan T. Jackson, CO Sept. 90 p463-467.

Who Owns Float? Jerry L. Householder and Hulan E. Rutland, CO Mar. 90 p130-133.

Contractors

Decision-Support System for Modeling Bid/No-Bid Decision Problem, Irtishad Ahmad, CO Dec. 90 p595-608.

Qualifier-2: Knowledge-Based System for Contractor Prequalification, Jeffrey S. Russell, Miroslaw J. Skibniewski and David R. Cozier, CO Mar. 90 p157-171.

Contracts

Pricing Construction Contracts Under Tax Reform Act of 1986, Foad Farid, CO June 90 p300-315.

Resolving Disputes over Contract Notice Requirements, H. Randolph Thomas, Gary R. Smith and Dennis E. Wright, CO Dec. 90 p738-755.

Technical Specifications' Effect on Construction, Jonathan T. Jackson, CO Sept. 90 p463-467.

Who Owns Float? Jerry L. Householder and Hulan E. Rutland, CO Mar. 90 p130-133.

Control systems

Bar Codes: Prescription for Precision, Performance, and Productivity, Lewis H. Blakey, CO Sept. 90 p468-479.

Bar Coding in Construction Engineering, William J. Rasdorf and Mark J. Herbert, CO June 90 p261-280.

Bar-Code Standardization in Industrial Construction, George Stukhart and E. Lynn Cook, CO Sept. 90 p416-431.

Conceptual Framework for Computer-Based Construction Safety Control, William A. Stanton and Jack H. Willenbrock, CO Sept. 90 p383-398.

Testing Bar-Code Technology In Construction Environment, Leonhard E. Bernold, CO Dec. 90 p643-655.

Cost analysis

Consequential Equipment Costs Associated with Lack of Availability and Downtime, Michael C. Vorster and Jesus M. De La Garza, CO Dec. 90 p656-669.

Cost Model for Reinforced Concrete Beam and Slab Structures in Buildings, Surinder Singh, CO Mar. 90 p54-67.

Cost control

New Approach to Construction Management, Timothy Ch. U. Kalu, CO Sept. 90 p494-513.

Predictors of Cost-Overrun Rates, Charles T. Jahren and Andrew M. Asha, CO Sept. 90 p548-552.

Cost effectiveness

Realistic Model for Equipment Replacement, A. Jaafari and V. K. Mateffy, CO Sept. 90 p514-532.

Cost estimates

Cost Model for Reinforced Concrete Beam and Slab Structures in Buildings, Surinder Singh, CO Mar. 90 p54-67.

Cost minimization

Computer-Aided Concrete-Placement Optimization, R. S. Phelan, F. Radjy, C. Haas and C. Hendrickson, CO Mar. 90 p172-187.

Cost savings

Construction Methods and Costs of Stress-Laminated Timber Bridges, Edward F. Sarisley, CO Sept. 90 p432-447.

Critical path method

New Approach to Construction Management, Timothy Ch. U. Kalu, CO Sept. 90 p494-513.

Packing Method for Resource Leveling (PACK), Robert B. Harris, CO June 90 p331-350.

Progress-Based Construction Scheduling, Mustafa Pultar, CO Dec. 90 p670-688.

Who Owns Float? Jerry L. Householder and Hulan E. Rutland, CO Mar. 90 p130-133.

Curricula

Database Systems for Evaluating Construction Programs, J. K. Yates, CO Dec. 90 p624-642.

Cylinders

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Data communication

Electronic Data Interchange in Construction, George E. Gibson, Jr. and Lansford C. Bell, CO Dec. 90 p727-737.

Database management systems

Bar Coding in Construction Engineering, William J. Rasdorf and Mark J. Herbert, CO June 90 p261-280.

Database Systems for Evaluating Construction Programs, J. K. Yates, CO Dec. 90 p624-642.

Decision-Support System for Modeling Bid/No-Bid Decision Problem, Irtishad Ahmad, CO Dec. 90 p595-608.

Databases

Computer-Aided Concrete-Placement Optimization, R. S. Phelan, F. Radjy, C. Haas and C. Hendrickson, CO Mar. 90 p172-187.

Decision making

Bids Considering Multiple Criteria, John Seydel and David L. Olson, CO Dec. 90 p609-623.

Decision-Support System for Modeling Bid/No-Bid Decision Problem, Irtishad Ahmad, CO Dec. 90 p595-608.

Evaluation of New Building Technology, James D. Lutz, Luh-Maan Chang and Thomas R. Napier, CO June 90 p281-299.

Qualifier-2: Knowledge-Based System for Contractor Prequalification, Jeffrey S. Russell, Miroslaw J. Skibniewski and David R. Cozier, CO Mar. 90 p157-171.

Delay time

Who Owns Float? Jerry L. Householder and Hulan E. Rutland, CO Mar. 90 p130-133.

Design

Factors Affecting Construction-Planning Outcomes, Alexander Laufer and Dora Cohenca, CO Mar. 90 p135-156.

Dewatering

Foundation Construction within Wastewater-Treatment Plant, Delon Hampton, J. Scott Jin and Edward A. Clark, CO Dec. 90 p564-573.

Downtime

Consequential Equipment Costs Associated with Lack of Availability and Downtime, Michael C. Vorster and Jesus M. De La Garza, CO Dec. 90 p656-669.

Drydocks

Construction of Difficult Dry Dock in Yokohama, Japan, Tsutomu Kumamoto, Hitoshi Kameda, Masaru Hoshiya and Kiyoshi Ishii, CO June 90 p201-220.

Earthwork

Further Development of Integer Programming in Earthwork Optimization, A. K. W. Jayawardane and F. C. Harris, CO Mar. 90 p18-34.

Economic analysis

Cost Model for Reinforced Concrete Beam and Slab Structures in Buildings, Surinder Singh, CO Mar. 90 p54-67.

Employment opportunities

Dilemmas Facing Construction Education and Research in 1990s, Clarkson H. Oglesby, CO Mar. 90 p4-17.

Engineering education

Database Systems for Evaluating Construction Programs, J. K. Yates, CO Dec. 90 p624-642.

Dilemmas Facing Construction Education and Research in 1990s, Clarkson H. Oglesby, CO Mar. 90 p4-17.

Equipment costs

Consequential Equipment Costs Associated with Lack of Availability and Downtime, Michael C. Vorster and Jesus M. De La Garza, CO Dec. 90 p656-669.

Evaluation

Evaluation of New Building Technology, James D. Lutz, Luh-Maan Chang and Thomas R. Napier, CO June 90 p281-299.

Qualifier-2: Knowledge-Based System for Contractor Prequalification, Jeffrey S. Russell, Miroslaw J. Skibniewski and David R. Cozier, CO Mar. 90 p157-171.

Expert systems

Expert Systems Applications in Construction Management and Engineering, Satish Mohan, CO Mar. 90 p87-99.

Hybrid Expert System for Construction Planning and Scheduling, Osama Moselhi and Matthew J. Nicholas, CO June 90 p221-238.

Integration of Simulation with Expert Systems, Ali Touran, CO Sept. 90 p480-493.

Network Resource Allocation with Support of a Fuzzy Expert System, T. C. Chang, C. William Ibbs and Keith C. Crandall, CO June 90 p239-260.

Qualifier-2: Knowledge-Based System for Contractor Prequalification, Jeffrey S. Russell, Miroslaw J. Skibniewski and David R. Cozier, CO Mar. 90 p157-171.

Fabrication

Advanced Fabrication and Erection Techniques for Long Suspension Bridge Cables, Minoru Matsuzaki, Chihiko Uchikawa and Takeshi Mitamura, CO Mar. 90 p112-129.

Feasibility studies

Surviving Failures: Lessons from Field Study, A. Jaafari and A. Schub, CO Mar. 90 p68-86.

Federal Republic of Germany

Surviving Failures: Lessons from Field Study, A. Jaafari and A. Schub, CO Mar. 90 p68-86.

Foundation construction

Foundation Construction within Wastewater-Treatment Plant, Delon Hampton, J. Scott Jin and Edward A. Clark, CO Dec. 90 p564-573.

Foundation design

Foundation Construction within Wastewater-Treatment Plant, Delon Hampton, J. Scott Jin and Edward A. Clark, CO Dec. 90 p564-573.

Fuzzy sets

Network Resource Allocation with Support of a Fuzzy Expert System, T. C. Chang, C. William Ibbs and Keith C. Crandall, CO June 90 p239-260.

Granular media

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Heuristics

Packing Method for Resource Leveling (PACK), Robert B. Harris, CO June 90 p331-350.

Information retrieval

Bar Coding in Construction Engineering, William J. Rasdorf and Mark J. Herbert, CO June 90 p261-280.

Information systems

Bar Coding in Construction Engineering, William J. Rasdorf and Mark J. Herbert, CO June 90 p261-280.

Conceptual Framework for Computer-Based Construction Safety Control, William A. Stanton and Jack H. Willenbrock, CO Sept. 90 p383-398.

Testing Bar-Code Technology In Construction Environment, Leonhard E. Bernold, CO Dec. 90 p643-655.

Innovation

Implementing Construction Research, Ben C. Gerwick, Jr., CO Dec. 90 p556-563.

Instrumentation

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Interactive systems

Applying Computer-Integrated Manufacturing Concepts to Construction, Victor E. Sanvido and Deborah J. Medeiros, CO June 90 p365-379.

Integration of Simulation with Expert Systems, Ali Touran, CO Sept. 90 p480-493.

Inventories

Bar Codes: Prescription for Precision, Performance, and Productivity, Lewis H. Blakey, CO Sept. 90 p468-479.

Bar Coding in Construction Engineering, William J. Rasdorf and Mark J. Herbert, CO June 90 p261-280.

Japan

Advanced Fabrication and Erection Techniques for Long Suspension Bridge Cables, Minoru Matsuzaki, Chihiko Uchikawa and Takeshi Mitamura, CO Mar. 90 p112-129.

Construction of Difficult Dry Dock in Yokohama, Japan, Tsutomu Kumamoto, Hitoshi Kameda, Masaru Hoshiya and Kiyoshi Ishii, CO June 90 p201-220.

Principal Nature of Management in Japanese Construction Industry, Keizo Baba, CO June 90 p351-364.

Jet grouting

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Knowledge-based systems

Expert Systems Applications in Construction Management and Engineering, Satish Mohan, CO Mar. 90 p87-99.

Qualifier-2: Knowledge-Based System for Contractor Prequalification, Jeffrey S. Russell, Miroslaw J. Skibniewski and David R. Cozier, CO Mar. 90 p157-171.

Labor

Modeling Construction Labor Productivity, H. Randolph Thomas, William F. Maloney, R. Malcolm W. Horner, Gary R. Smith, Vir K. Handa and Steve R. Sanders, CO Dec. 90 p705-726.

Laminated wood

Construction Methods and Costs of Stress-Laminated Timber Bridges, Edward F. Sarisley, CO Sept. 90 p432-447.

Legal factors

Resolving Disputes over Contract Notice Requirements, H. Randolph Thomas, Gary R. Smith and Dennis E. Wright, CO Dec. 90 p738-755.

Life cycles

Realistic Model for Equipment Replacement, A. Jaafari and V. K. Mateffy, CO Sept. 90 p514-532.

Lifting

Lift of Shippingport Reactor Pressure Vessel, David Duerr, CO Mar. 90 p188-197.

Linear programming

Further Development of Integer Programming in Earthwork Optimization, A. K. W. Jayawardane and F. C. Harris, CO Mar. 90 p18-34.

Linearity

RPM: Repetitive Project Modeling, Rehab M. Reda, CO June 90 p316-330.

Litigation

Technical Specifications' Effect on Construction, Jonathan T. Jackson, CO Sept. 90 p463-467.

Management

Modeling Construction Labor Productivity, H. Randolph Thomas, William F. Maloney, R. Malcolm W. Horner, Gary R. Smith, Vir K. Handa and Steve R. Sanders, CO Dec. 90 p705-726.

Management methods

Construction of Difficult Dry Dock in Yokohama, Japan, Tsutomu Kumamoto, Hitoshi Kameda, Masaru Hoshiya and Kiyoshi Ishii, CO June 90 p201-220.

Pricing Construction Contracts Under Tax Reform Act of 1986, Foad Farid, CO June 90 p300-315.

Productivity Improvement Tool: Camcorders, Neil N. Eldin and Stephan Egger, CO Mar. 90 p100-111.

Management systems

Framework for Construction Robot Fleet Management System, Jeffrey S. Russell, Miroslaw J. Skibniewski and Jorge A. Vanegas, CO Sept. 90 p448-462.

Principal Nature of Management in Japanese Construction Industry, Keizo Baba, CO June 90 p351-364.

Materials

Bar-Code Standardization in Industrial Construction, George Stukhart and E. Lynn Cook, CO Sept. 90 p416-431.

Materials testing

Testing Bar-Code Technology In Construction Environment, Leonhard E. Bernold, CO Dec. 90 p643-655.

Microcomputers

Hybrid Expert System for Construction Planning and Scheduling, Osama Moselhi and Matthew J. Nicholas, CO June 90 p221-238.

Modeling

RPM: Repetitive Project Modeling, Rehab M. Reda, CO June 90 p316-330.

Models

Consequential Equipment Costs Associated with Lack of Availability and Downtime, Michael C. Vorster and Jesus M. De La Garza, CO Dec. 90 p656-669.

Modeling Construction Labor Productivity, H. Randolph Thomas, William F. Maloney, R. Malcolm W. Horner, Gary R. Smith, Vir K. Handa and Steve R. Sanders, CO Dec. 90 p705-726.

Realistic Model for Equipment Replacement, A. Jaafari and V. K. Mateffy, CO Sept. 90 p514-532.

Systematic Risk Management Approach for Construction Projects, Jamal F. Al-Bahar and Keith C. Crandall, CO Sept. 90 p533-546.

Motivation

Modeling Construction Labor Productivity, H. Randolph Thomas, William F. Maloney, R. Malcolm W. Horner, Gary R. Smith, Vir K. Handa and Steve R. Sanders, CO Dec. 90 p705-726.

Nuclear power plant decommissioning

Lift of Shippingport Reactor Pressure Vessel, David Duerr, CO Mar. 90 p188-197.

Nuclear power plants

Lift of Shippingport Reactor Pressure Vessel, David Duerr, CO Mar. 90 p188-197.

Nuclear wastes disposal

Lift of Shippingport Reactor Pressure Vessel, David Duerr, CO Mar. 90 p188-197.

Operating costs

Consequential Equipment Costs Associated with Lack of Availability and Downtime, Michael C. Vorster and Jesus M. De La Garza, CO Dec. 90 p656-669.

Optimization

Bids Considering Multiple Criteria, John Seydel and David L. Olson, CO Dec. 90 p609-623.

Computer-Aided Concrete-Placement Optimization, R. S. Phelan, F. Radjy, C. Haas and C. Hendrickson, CO Mar. 90 p172-187.

Optimization models

Further Development of Integer Programming in Earthwork Optimization, A. K. W. Jayawardane and F. C. Harris, CO Mar. 90 p18-34.

Pennsylvania

Lift of Shippingport Reactor Pressure Vessel, David Duerr, CO Mar. 90 p188-197.

Performance evaluation

Framework for Analysis of Performance, William F. Maloney, CO Sept. 90 p399-415.

Pile load tests

Foundation Construction within Wastewater-Treatment Plant, Delon Hampton, J. Scott Jin and Edward A. Clark, CO Dec. 90 p564-573.

Pricing

Pricing Construction Contracts Under Tax Reform Act of 1986, Foad Farid, CO June 90 p300-315.

Probabilistic methods

Probabilistic Simulation Studies for Repetitive Construction Processes, Simaan M. AbouRizk and Daniel W. Halpin, CO Dec. 90 p575-594.

Probability theory

Network Resource Allocation with Support of a Fuzzy Expert System, T. C. Chang, C. William Ibbs and Keith C. Crandall, CO June 90 p239-260.

Production engineering

Applying Computer-Integrated Manufacturing Concepts to Construction, Victor E. Sanvido and Deborah J. Medeiros, CO June 90 p365-379.

Productivity

Applying Computer-Integrated Manufacturing Concepts to Construction, Victor E. Sanvido and Deborah J. Medeiros, CO June 90 p365-379.

Bar Codes: Prescription for Precision, Performance, and Productivity, Lewis H. Blakey, CO Sept. 90 p468-479.

Consequential Equipment Costs Associated with Lack of Availability and Downtime, Michael C. Vorster and Jesus M. De La Garza, CO Dec. 90 p656-669.

Hybrid Expert System for Construction Planning and Scheduling, Osama Moselhi and Matthew J. Nicholas, CO June 90 p221-238.

Modeling Construction Labor Productivity, H. Randolph Thomas, William F. Maloney, R. Malcolm W. Horner, Gary R. Smith, Vir K. Handa and Steve R. Sanders, CO Dec. 90 p705-726.

Productivity Improvement Tool: Camcorders, Neil N. Eldin and Stephan Egger, CO Mar. 90 p100-111.

Profits

Pricing Construction Contracts Under Tax Reform Act of 1986, Foad Farid, CO June 90 p300-315.

Project control

Formal Development of Line-of-Balance Technique, Zohair M. Al Sarraj, CO Dec. 90 p689-704.

Network Resource Allocation with Support of a Fuzzy Expert System, T. C. Chang, C. William Ibbs and Keith C. Crandall, CO June 90 p239-260.

Project evaluation

Framework for Analysis of Performance, William F. Maloney, CO Sept. 90 p399-415.

Project management

Bar Coding in Construction Engineering, William J. Rasdorf and Mark J. Herbert, CO June 90 p261-280.

Formal Development of Line-of-Balance Technique, Zohair M. Al Sarraj, CO Dec. 90 p689-704.

Framework for Analysis of Performance, William F. Maloney, CO Sept. 90 p399-415.

Packing Method for Resource Leveling (PACK), Robert B. Harris, CO June 90 p331-350.

Progress-Based Construction Scheduling, Mustafa Pultar, CO Dec. 90 p670-688.

Surviving Failures: Lessons from Field Study, A. Jaafari and A. Schub, CO Mar. 90 p68-86.

Systematic Risk Management Approach for Construction Projects, Jamal F. Al-Bahar and Keith C. Crandall, CO Sept. 90 p533-546.

Project planning

RPM: Repetitive Project Modeling, Rehab M. Reda, CO June 90 p316-330.

Systematic Risk Management Approach for Construction Projects, Jamal F. Al-Bahar and Keith C. Crandall, CO Sept. 90 p533-546.

Project specifications

Technical Specifications' Effect on Construction, Jonathan T. Jackson, CO Sept. 90 p463-467.

Quality control

Construction of Difficult Dry Dock in Yokohama, Japan, Tsutomu Kumamoto, Hitoshi Kameda, Masaru Hoshiya and Kiyoshi Ishii, CO June 90 p201-220.

Research

Dilemmas Facing Construction Education and Research in 1990s, Clarkson H. Oglesby, CO Mar. 90 p4-17.

Research and development

Implementing Construction Research, Ben C. Gerwick, Jr., CO Dec. 90 p556-563.

Resource allocation

Network Resource Allocation with Support of a Fuzzy Expert System, T. C. Chang, C. William Ibbs and Keith C. Crandall, CO June 90 p239-260.

Resource management

New Approach to Construction Management, Timothy Ch. U. Kalu, CO Sept. 90 p494-513.

Packing Method for Resource Leveling (PACK), Robert B. Harris, CO June 90 p331-350.

Resources

Packing Method for Resource Leveling (PACK), Robert B. Harris, CO June 90 p331-350.

Risk analysis

Surviving Failures: Lessons from Field Study, A. Jaafari and A. Schub, CO Mar. 90 p68-86.

Systematic Risk Management Approach for Construction Projects, Jamal F. Al-Bahar and Keith C. Crandall, CO Sept. 90 p533-546.

Risk management

Surviving Failures: Lessons from Field Study, A. Jaafari and A. Schub, CO Mar. 90 p68-86.

Systematic Risk Management Approach for Construction Projects, Jamal F. Al-Bahar and Keith C. Crandall, CO Sept. 90 p533-546.

Risk taking

Surviving Failures: Lessons from Field Study, A. Jaafari and A. Schub, CO Mar. 90 p68-86.

Road construction

Further Development of Integer Programming in Earthwork Optimization, A. K. W. Jayawardane and F. C. Harris, CO Mar. 90 p18-34.

Robotics

Framework for Construction Robot Fleet Management System, Jeffrey S. Russell, Miroslaw J. Skibniewski and Jorge A. Vanegas, CO Sept. 90 p448-462.

Safety

Conceptual Framework for Computer-Based Construction Safety Control, William A. Stanton and Jack H. Willenbrock, CO Sept. 90 p383-398.

Scheduling

Factors Affecting Construction-Planning Outcomes, Alexander Laufer and Dora Cohenca, CO Mar. 90 p135-156.

Formal Development of Line-of-Balance Technique, Zohair M. Al Sarraj, CO Dec. 90 p689-704.

Hybrid Expert System for Construction Planning and Scheduling, Osama Moselhi and Matthew J. Nicholas, CO June 90 p221-238.

Network Resource Allocation with Support of a Fuzzy Expert System, T. C. Chang, C. William Ibbs and Keith C. Crandall, CO June 90 p239-260.

Packing Method for Resource Leveling (PACK), Robert B. Harris, CO June 90 p331-350.

Progress-Based Construction Scheduling, Mustafa Pultar, CO Dec. 90 p670-688.

Who Owns Float? Jerry L. Householder and Hulan E. Rutland, CO Mar. 90 p130-133.

Settlement control

Foundation Construction within Wastewater-Treatment Plant, Delon Hampton, J. Scott Jin and Edward A. Clark, CO Dec. 90 p564-573.

Simulation

Integration of Simulation with Expert Systems, Ali Touran, CO Sept. 90 p480-493.

Probabilistic Simulation Studies for Repetitive Construction Processes, Simaan M. AbouRizk and Daniel W. Halpin, CO Dec. 90 p575-594.

Simulation models

Probabilistic Simulation Studies for Repetitive Construction Processes, Simaan M. AbouRizk and Daniel W. Halpin, CO Dec. 90 p575-594.

Soil cement

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Soil deformation

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Soil settlement

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Soils

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Specifications

Construction Methods and Costs of Stress-Laminated Timber Bridges, Edward F. Sarisley, CO Sept. 90 p432-447.

Technical Specifications' Effect on Construction, Jonathan T. Jackson, CO Sept. 90 p463-467.

Standards

Bar-Code Standardization in Industrial Construction, George Stukhart and E. Lynn Cook, CO Sept. 90 p416-431.

Statistical analysis

Construction of Difficult Dry Dock in Yokohama, Japan, Tsutomu Kumamoto, Hitoshi Kameda, Masaru Hoshiya and Kiyoshi Ishii, CO June 90 p201-220.

Taxation

Pricing Construction Contracts Under Tax Reform Act of 1986, Foad Farid, CO June 90 p300-315.

Technology

Bar Codes: Prescription for Precision, Performance, and Productivity, Lewis H. Blakey, CO Sept. 90 p468-479.

Evaluation of New Building Technology, James D. Lutz, Luh-Maan Chang and Thomas R. Napier, CO June 90 p281-299.

Testing Bar-Code Technology In Construction Environment, Leonhard E. Bernold, CO Dec. 90 p643-655.

Telecommunication

Electronic Data Interchange in Construction, George E. Gibson, Jr. and Lansford C. Bell, CO Dec. 90 p727-737.

Timber construction

Construction Methods and Costs of Stress-Laminated Timber Bridges, Edward F. Sarisley, CO Sept. 90 p432-447.

Tunnel supports

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Tunnels

Temporary Tunnel Support Using Jet-Grouted Cylinders, C. Stella, G. Ceppi and E. D'Appolonia, CO Mar. 90 p35-53.

Uncertainty analysis

Factors Affecting Construction-Planning Outcomes, Alexander Laufer and Dora Cohenca, CO Mar. 90 p135-156.

Network Resource Allocation with Support of a Fuzzy Expert System, T. C. Chang, C. William Ibbs and Keith C. Crandall, CO June 90 p239-260.

Underwater construction

Construction of Difficult Dry Dock in Yokohama, Japan, Tsutomu Kumamoto, Hitoshi Kameda, Masaru Hoshiya and Kiyoshi Ishii, CO June 90 p201-220.

United States

Principal Nature of Management in Japanese Construction Industry, Keizo Baba, CO June 90 p351-364.

Variance analysis

Factors Affecting Construction-Planning Outcomes, Alexander Laufer and Dora Cohenca, CO Mar. 90 p135-156.

Videotape

Productivity Improvement Tool: Camcorders, Neil N. Eldin and Stephan Egger, CO Mar. 90 p100-111.

Wastewater treatment

Foundation Construction within Wastewater-Treatment Plant, Delon Hampton, J. Scott Jin and Edward A. Clark, CO Dec. 90 p564-573.

Water treatment plants

Foundation Construction within Wastewater-Treatment Plant, Delon Hampton, J. Scott Jin and Edward A. Clark, CO Dec. 90 p564-573.

AUTHOR INDEX

AbouRizk, Simaan M.
Probabilistic Simulation Studies for Repetitive Construction Processes, with Daniel W. Halpin, CO Dec. 90, p575-594

Ahmad, Irtishad
Decision-Support System for Modeling Bid/No-Bid Decision Problem, CO Dec. 90, p595-608

Al Sarraj, Zohair M.
Formal Development of Line-of-Balance Technique, CO Dec. 90, p689-704

Al-Bahar, Jamal F.
Systematic Risk Management Approach for Construction Projects, with Keith C. Crandall, CO Sept. 90, p533-546

Asha, Andrew M.
see Jahren, Charles T., CO Sept. 90, p548-552

Baba, Keizo
Principal Nature of Management in Japanese Construction Industry, CO June 90, p351-364

Bell, Lansford C.
see Gibson, George E., Jr., CO Dec. 90, p727-737

Bernold, Leonhard E.
Testing Bar-Code Technology In Construction Environment, CO Dec. 90, p643-655

Blakey, Lewis H.
Bar Codes: Prescription for Precision, Performance, and Productivity, CO Sept. 90, p468-479

Ceppi, G.
see Stella, C., CO Mar. 90, p35-53

Chang, Lub-Maan
see Lutz, James D., CO June 90, p281-299

Chang, T. C.
Network Resource Allocation with Support of a Fuzzy Expert System, with C. William Ibbs and Keith C. Crandall, CO June 90, p239-260

Clark, Edward A.
see Hampton, Delon, CO Dec. 90, p564-573

Cobenca, Dora
see Laufer, Alexander, CO Mar. 90, p135-156

Cook, E. Lynn
see Stukhart, George, CO Sept. 90, p416-431

Cozier, David R.
see Russell, Jeffrey S., CO Mar. 90, p157-171

Crandall, Keith C.
see Al-Bahar, Jamal F., CO Sept. 90, p533-546
see Chang, T. C., CO June 90, p239-260

D'Appolonia, E.
see Stella, C., CO Mar. 90, p35-53

De La Garza, Jesus M.
see Vorster, Michael C., CO Dec. 90, p656-669

Duerr, David
Lift of Shippingport Reactor Pressure Vessel, CO Mar. 90, p188-197

Egger, Stephan
see Eldin, Neil N., CO Mar. 90, p100-111

Eldin, Neil N.
Productivity Improvement Tool: Camcorders, with Stephan Egger, CO Mar. 90, p100-111

Farid, Foad
Pricing Construction Contracts Under Tax Reform Act of 1986, CO June 90, p300-315

Gerwick, Ben C., Jr.
Implementing Construction Research, CO Dec. 90, p556-563

Gibson, George E., Jr.
Electronic Data Interchange in Construction, with Lansford C. Bell, CO Dec. 90, p727-737

Haas, C.
see Phelan, R. S., CO Mar. 90, p172-187

Halpin, Daniel W.
see AbouRizk, Simaan M., CO Dec. 90, p575-594

Hampton, Delon
Foundation Construction within Wastewater-Treatment Plant, with J. Scott Jin and Edward A. Clark, CO Dec. 90, p564-573

Handa, Vir K.
see Thomas, H. Randolph, CO Dec. 90, p705-726

Harris, F. C.
see Jayawardane, A. K. W., CO Mar. 90, p18-34

Harris, Robert B.
Packing Method for Resource Leveling (PACK), CO June 90, p331-350

Hendrickson, C.
see Phelan, R. S., CO Mar. 90, p172-187

Herbert, Mark J.
see Rasdorf, William J., CO June 90, p261-280

Horner, R. Malcolm W.
see Thomas, H. Randolph, CO Dec. 90, p705-726

Hoshiya, Masaru
see Kumamoto, Tsutomu, CO June 90, p201-220

Householder, Jerry L.
Who Owns Float?, with Hulan E. Rutland, CO Mar. 90, p130-133

Ibbs, C. William
see Chang, T. C., CO June 90, p239-260

Ishii, Kiyoshi
see Kumamoto, Tsutomu, CO June 90, p201-220

Jaafari, A.
Realistic Model for Equipment Replacement, with V. K. Mateffy, CO Sept. 90, p514-532
Surviving Failures: Lessons from Field Study, with A. Schub, CO Mar. 90, p68-86

Jackson, Jonathan T.
Technical Specifications' Effect on Construction, CO Sept. 90, p463-467

Jahren, Charles T.
Predictors of Cost-Overrun Rates, with Andrew M. Asha, CO Sept. 90, p548-552

Jayawardane, A. K. W.
Further Development of Integer Programming in Earthwork Optimization, with F. C. Harris, CO Mar. 90, p18-34

Jin, J. Scott
see Hampton, Delon, CO Dec. 90, p564-573

Kalu, Timothy Ch. U.
New Approach to Construction Management, CO Sept. 90, p494-513

Kameda, Hitoshi
see Kumamoto, Tsutomu, CO June 90, p201-220

Kumamoto, Tsutomu
Construction of Difficult Dry Dock in Yokohama, Japan, with Hitoshi Kameda, Masaru Hoshiya and Kiyoshi Ishii, CO June 90, p201-220

Laufer, Alexander
Factors Affecting Construction-Planning Outcomes, with Dora Cohenca, CO Mar. 90, p135-156

Lutz, James D.
Evaluation of New Building Technology, with Luh-Maan Chang and Thomas R. Napier, CO June 90, p281-299

Maloney, William F.
Framework for Analysis of Performance, CO Sept. 90, p399-415
see Thomas, H. Randolph, CO Dec. 90, p705-726

Mateffy, V. K.
see Jaafari, A., CO Sept. 90, p514-532

Matsuzaki, Minoru
Advanced Fabrication and Erection Techniques for Long Suspension Bridge Cables, with Chihiko Uchikawa and Takeshi Mitamura, CO Mar. 90, p112-129

Medeiros, Deborah J.
see Sanvido, Victor E., CO June 90, p365-379

Mitamura, Takeshi
see Matsuzaki, Minoru, CO Mar. 90, p112-129

Mohan, Satish
Expert Systems Applications in Construction Management and Engineering, CO Mar. 90, p87-99

Moselhi, Osama
Hybrid Expert System for Construction Planning and Scheduling, with Matthew J. Nicholas, CO June 90, p221-238

Napier, Thomas R.
see Lutz, James D., CO June 90, p281-299

Nicholas, Matthew J.
see Moselhi, Osama, CO June 90, p221-238

Oglesby, Clarkson H.
Dilemmas Facing Construction Education and Research in 1990s, CO Mar. 90, p4-17

Olson, David L.
see Seydel, John, CO Dec. 90, p609-623

Phelan, R. S.
Computer-Aided Concrete-Placement Optimization, with F. Kadjy, C. Haas and C. Hendrickson, CO Mar. 90, p172-187

Pultar, Mustafa
Progress-Based Construction Scheduling, CO Dec. 90, p670-688

Radjy, F.
see Phelan, R. S., CO Mar. 90, p172-187

Rasdorf, William J.
Bar Coding in Construction Engineering, with Mark J. Herbert, CO June 90, p261-280

Reda, Rehab M.
RPM: Repetitive Project Modeling, CO June 90, p316-330

Russell, Jeffrey S.
Framework for Construction Robot Fleet Management System, with Miroslaw J. Skibniewski and Jorge A. Vanegas, CO Sept. 90, p448-462
Qualifier-2: Knowledge-Based System for Contractor Prequalification, with Miroslaw J. Skibniewski and David R. Cozier, CO Mar. 90, p157-171

Rutland, Hulan E.
see Householder, Jerry L., CO Mar. 90, p130-133

Sanders, Steve R.
see Thomas, H. Randolph, CO Dec. 90, p705-726

Sanvido, Victor E.
Applying Computer-Integrated Manufacturing Concepts to Construction, with Deborah J. Medeiros, CO June 90, p365-379

Sarisley, Edward F.
Construction Methods and Costs of Stress-Laminated Timber Bridges, CO Sept. 90, p432-447

Schub, A.
see Jaafari, A., CO Mar. 90, p68-86

Seydel, John
Bids Considering Multiple Criteria, with David L. Olson, CO Dec. 90, p609-623

Singh, Surinder
Cost Model for Reinforced Concrete Beam and Slab Structures in Buildings, CO Mar. 90, p54-67

Skibniewski, Miroslaw J.
see Russell, Jeffrey S., CO Mar. 90, p157-171
see Russell, Jeffrey S., CO Sept. 90, p448-462

Smith, Gary R.
see Thomas, H. Randolph, CO Dec. 90, p705-726
see Thomas, H. Randolph, CO Dec. 90, p738-755

Stanton, William A.
Conceptual Framework for Computer-Based Construction Safety Control, with Jack H. Willenbrock, CO Sept. 90, p383-398

Stella, C.
Temporary Tunnel Support Using Jet-Grouted Cylinders, with G. Ceppi and E. D'Appolonia, CO Mar. 90, p35-53

Stukhart, George
Bar-Code Standardization in Industrial Construction, with E. Lynn Cook, CO Sept. 90, p416-431

Thomas, H. Randolph
Modeling Construction Labor Productivity, with William F. Maloney, R. Malcolm W. Horner, Gary R. Smith, Vir K. Handa and Steve R. Sanders, CO Dec. 90, p705-726
Resolving Disputes over Contract Notice Requirements, with Gary R. Smith and Dennis E. Wright, CO Dec. 90, p738-755

Touran, Ali
Integration of Simulation with Expert Systems, CO Sept. 90, p480-493

Uchikawa, Chihiko
see Matsuzaki, Minoru, CO Mar. 90, p112-129

Vanegas, Jorge A.
see Russell, Jeffrey S., CO Sept. 90, p448-462

Vorster, Michael C.
Consequential Equipment Costs Associated with Lack of Availability and Downtime, with Jesus M. De La Garza, CO Dec. 90, p656-669

Willenbrock, Jack H.
see Stanton, William A., CO Sept. 90, p383-398

Wright, Dennis E.
see Thomas, H. Randolph, CO Dec. 90, p738-755

Yates, J. K.
Database Systems for Evaluating Construction Programs, CO Dec. 90, p624-642